

GEOLOGICAL SURVEY OF CANADA
ALFRED R. C. SELWYN, C.M.G., LL.D., F.R.S., DIRECTOR

REPORT

ON

PORTIONS OF THE PROVINCE OF QUEBEC

AND ADJOINING AREAS IN

NEW BRUNSWICK AND MAINE

RELATING MORE ESPECIALLY TO THE

COUNTIES OF TEMISCOUATA AND RIMOUSKI, P.Q.

BY

L. W. BAILEY, PH.D., F.R.S.C.

AND

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OTTAWA

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A. R. C. SELWYN, C.M.G., LL.D., F.R.S., &c.,
Director of the Geological Survey.

SIR,—I have the honour to submit the following report of observations and explorations made by myself and Mr. W. McInnes, with the assistance of Mr. J. W. Bailey, in portions of the province of Quebec and adjacent areas in Maine and New Brunswick, chiefly during the summers of 1887 and 1888.

The report is accompanied by a quarter-sheet map, representing portions of Temiscouata and Rimouski counties, being continuous on the one hand with the series already issued of the adjoining portions of the province of New Brunswick, and on the other with those prepared by Dr. R. W. Ells in illustration of the geology of the Gaspé peninsula.

I have the honour to be, sir,
Your obedient servant,
L. W. BAILEY.

FREDERICTON, 25th November, 1890.

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The rocks to which this report relates are a portion of those Previous reports, which have been commonly known as the Quebec group. As is well known, the latter have been the subject of much previous investigation, both by the officers of the Geological Survey and others, numerous reports and memoirs having been at various times published concerning them. The most recent of these, upon the part of the Geological Survey, are those of Dr. R. W. Ells, who in Vols. II. and III., New Series of the Survey publications, has given not only a full historical summary of the progress of the investigation, but from a minute study of the rocks in the vicinity of Quebec, supplemented by explorations extending from the Vermont boundary to the extremity of the Gaspé peninsula, has brought forward data, both of a stratigraphical and palaeontological character, which, while in important particulars at variance with views previously announced, seem to place the main facts of the case beyond further controversy.

The most important of the conclusions thus arrived at, so far as Dr. Ells's conclusions. they bear upon the region to be considered in the present report, may be briefly stated as follows:—

- (1.) The larger part, if not the whole, of what was at one time known as the "altered Quebec group," is now regarded as a portion of an older and independent series of Pre-Cambrian age.

Lévis.

(2.) Of the two main groups into which the so-called Quebec group was originally divided, viz., the Sillery and Lévis (the division known as the "Lauzon" having been subsequently introduced and then abandoned), the latter or Lévis section, which up to 1888 was regarded as the older of the two, is now considered to be the more recent, the name "Lévis" being, however, restricted to the group of blackish green and gray shales which, as seen at Lévis and St. Joseph, contain characteristic graptolites of Calciferous-Chazy age, together with the associated limestones and limestone-conglomerates—the matrix of the latter also carrying typical fossils of the Calciferous formation, while the inclosed pebbles are wholly of Cambrian or Potsdam age.

Citadel rocks.

(3.) That a portion of the rocks forming the bluffs underlying the city of Quebec, as well as a portion of the Island of Orleans, and designated as the "Citadel rocks," which were at one time regarded as forming a portion of the Lévis group, are, as shown by their fossils, distinct from and more recent than the latter.

Sillery.

(4.) That the rocks of the "Sillery" formation, as thus understood and limited, contain a fauna corresponding to that of the Upper Cambrian series, its upper beds perhaps merging into those of the Lévis group, which is referred to the Lower Ordovician or Cambro-Silurian system, while at its base, and representing the Lower-Cambrian, is a series of beds in which, as yet, no fossils have been found. The Quebec citadel rocks have also been referred to the Cambro-Silurian or Ordovician system, and carry a fauna which is distinctly of Trenton-Utica aspect, and is followed upwards by fossiliferous Utica and Hudson River shales.

Potsdam.

To the above it may be added that the separation of a portion of the rocks about Quebec, as well as eastward along the Lower St. Lawrence, under the designation of "Potsdam," and its subdivision into three sections, as proposed and mapped by Mr. Richardson, is untenable, the fossils upon which this arrangement was based having been found to occur only in the pebbles of the conglomerates from which they were obtained, and not in the rock itself.

In describing the region examined by us we shall assume that these conclusions are correct, nothing having been observed by us which is in conflict with them, while they seem to afford the most satisfactory explanation of such facts as we have observed.

Region described.

The region referred to, represented in accompanying maps, lies almost wholly in the province of Quebec, having as its central and chief portion the county of Temiscouata, but including also a small part of Rimouski county, as well as portions of the counties of Madawaska and Restigouche, in the province of New Brunswick. Sheet No. 18 S.E.

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lies immediately north of sheet No. 17 N.E. of the series of New Brunswick maps, and in turn is followed north by sheet No. 18 N.E. embracing chiefly the region drained by the Rimouski and Metis rivers, while sheet No. 18 S.W. embraces a similar small area about Rivière du Loup. The area thus indicated, and to be presently described, is on the eastern side continuous with that described and mapped by Dr. R. W. Ells about the headwaters of the Restigouche and Metapedia rivers (No. 3 S.W. Quebec maps); and on the west adjoins the areas in Kamouraska county, described but not yet mapped by the same author. On the north side the several sheets terminate, so far as our investigations are concerned, with the south shore of the St. Lawrence River, between Rivière du Loup and Little Metis. The rock formations included within the area above defined are, as far as known, but two in number, viz., the Silurian and the Cambrian, with possibly small unrecognized areas of Cambro-Silurian or Ordovician.

SILURIAN.

The rocks of this system, as found within the areas here considered, have been quite fully described in previous reports, their stratigraphy, fossils and correlations with other Silurian districts, especially in New Brunswick, Maine and Nova Scotia, having been stated in considerable detail. We have no further information concerning them, so far as they occur within the area now under discussion, but a question having arisen as to their western extension and their separation from older and lithologically similar strata about the sources of the St. John River, some particulars may here be given of an exploration of the latter having in view the more exact determination of these points.

As represented upon Lake Temiscouata the portion of the Silurian system which immediately adjoins and overlaps the Cambrian strata to be presently described, does not represent the lowest member of that system, being composed of white sandstones and overlying calcareous rocks, of which the fossils indicate an age ranging from the lower to the upper part of the Lower Helderberg horizon, while at a short distance south are heavy conglomerates followed by hard sandstones and shales containing fossils chiefly of the Niagara formation. The larger part of these beds occur only upon the eastern side of the lake, where the calcareous strata form the prominent eminence known as Mt. Wissick; but upon the western side, the only fossiliferous strata observed are a few shales, imperfectly exposed about a mile northward from the village of Cabano. The older conglomerates and sandstones of the Niagara group are, however, well exposed here and may be followed

westerly for several miles along the road leading to the mills on the Cabano River. Immediately to the south of the above undoubted Silurian slates, Silurian strata is found the great series of slates first described in the Geology of Canada in connection with the Gaspé series, and which has since been found to spread so widely over the northern portions of New Brunswick, as well as adjacent areas in Quebec and Maine. These slates, as seen along the lower half of Temiscouata Lake and on the Madawaska River, are of gray, bluish-gray and dark gray, rarely black colours, often weathering to a dull olive-green, very fine grained but including harder bands, and generally more or less calcareous. They are throughout characterized by numerous and often intricate contortions and these, with a strongly developed slaty cleavage, make any attempt to determine their thickness or relations well nigh hopeless. Neither on the Lake nor on the Madawaska have they been found to contain any fossils, these having probably been obliterated by molecular movements; but the occurrence of fossils at many different points in the resembling strata which spread so widely to the east and south, and all of which indicate a Silurian horizon, seem to justify the position first assigned them as also Silurian, and as the equivalent of the upper part of the Gaspé series. In ascending the River St. John from Edmundston, slates which are evidently the same as those of the Madawaska and Lake Temiscouata are frequently exposed upon its banks as far as the mouth of the St. Francis River. They exhibit the same alternations of fine and soft with somewhat harder, sandy beds, have the same greenish, somewhat chloritic aspect, and the same strong and nearly vertical cleavage. The dips, when recognizable, are usually low, and indicate a series of broad and open undulations. Two miles above Edmundston the dips are north-easterly, at angles of 30° ; at Mechan's Rapids, six miles above, the inclination of the beds is $N. 10^\circ E. < 40^\circ$; about ten miles up it is $S. 30^\circ E. < 30^\circ$; and about half a mile below Baker River, where the beds are finely exposed, it is about $N. 80^\circ E. < 15^\circ$. At the Narrows, about five miles above Fort Kent, the slates, here finely banded, dip $S. 40^\circ E. < 85^\circ$, a dip which is repeated, or nearly so, two miles further up. At Connors's Landing, ten miles above Fort Kent, the dip is $N. 20^\circ E. < 70^\circ$.

On the St. Francis River the exposures are but few, but such as occur are quite similar to those on the main St. John, and have similar low inclinations, mostly to the southward, and the same peculiar greenish tint. No trace either of the limestones or the conglomerates of Lake Temiscouata could be found on this stream, but blocks of whitish-weathering sandstone, similar to those found at the base of Mount Wissick, which occur a little below the foot of Pohenegamook,

or Boundary Lake, appear to indicate that the northern boundary of Pohenegamook Lake, the Silurian is not far from this place. In the map of Mr. Richardson, the country on either side of the lake to its head is represented as Silurian, but the earlier description given in the Geology of Canada, 1863, is, without doubt, the correct one; the only strata visible being hard glossy slates of the Cambrian system. Above the St. Francis, the main river lies wholly in American territory, and presents much the same aspect as in the portion already described, the bluish, greenish-weathering slates showing frequent outcrops, which are often characterized by short and sharp foldings of the strata, the latter being, at the same time, cut by strong and highly inclined cleavage planes. The scenery of this portion of the St. John is very striking, the bordering hills, which are quite high, sometimes exhibiting strongly serrated outlines, while between them and the river are belts of terraced flats and intervale, most of which are cultivated. Access to the upper farms is, however, difficult, there being no roads whatever, while communication by water, effected in summer by canoes or tow-boats, and in the winter on the ice, is impeded by the numerous and sometimes dangerous rapids. These are, in some instances, due to ledges, but not unfrequently also to accumulations of boulders, which cross the river in trains, and by their grouping and character, suggest that they are of morainic origin.

Description of
Upper St.
John River.

Ascending the Little Black River, which joins the St. John about twenty miles above the mouth of the St. Francis, only one exposure, of blue slates, was observed in the first eight miles, the stream being exceedingly tortuous, and bordered either by extensive low flats or by banks of stratified clay or gravel. In some places the clays have an observed thickness of ten or twelve feet, and are covered by thirty or forty feet of sand, with from three to four feet of coarse gravel between the two. About twelve miles up, the still-waters cease, and about fifteen miles up, occurs strata, which, probably, mark the limit of the Silurian in this direction. They occur about the junction with the north-east branch, and consist, in part, of black slates, which are somewhat graphitic, and with which are associated purplish-gray, red-weathering slates, and partly of a hard gray grit and conglomerate, containing pebbles of black slate and white quartz. Their dip is S. 40° E. < 60 . These were at first believed to belong to, and represent the base of, the Silurian system, but comparisons since made, lead us to think that they belong rather to the Cambrian system, of which undoubted strata occur a short distance farther up the stream.

Between Little and Big Black rivers, upon the main St. John, gray, bluish and greenish-weathering argillites, continue to be the only rocks

Geology of
Upper St.
John.Settlement at
Seven Islands.

Conglomerate.

seen *in situ*, though boulders of metamorphic rocks, including hard sandstones, red slates and conglomerates, become abundant, and by their accumulation at certain points, cause long and dangerous rapids. In the report of the Geological Survey of Maine, and in an accompanying map, all this portion of the valley of the river, and for many miles above it, is represented as composed of talcose schists, but we looked in vain for anything to which that name could fairly be applied. Some of the slates found here are glossy, and, perhaps, a little unctuous, and they often contain scattered scales of mica, but to no greater extent than do many of the slates on Lake Temiscouata and in northern New Brunswick, which are certainly nothing more than ordinary argillites. They exhibit also the same greenish-chloritic aspect, becoming brownish-red under the influence of water, already noted as characterizing the slates to the eastward. The best exposures are at Big Black Rapids, and outcrops occur at intervals from this point to Hunter's, ten miles below the Seven Islands. Their strike is almost uniformly S. W., and the dip north-westerly, at high angles. The land on either side of the river is here much lower than further down the stream, the hills being few and of slight elevation; while the stream itself, though broad, is much encumbered with boulders, which, as below, appear to cross its course in trains, and are the cause of numerous and difficult rapids. From Hunter's to the Seven Islands, the navigation is easier, with more still-water and fewer ledges and boulders, while at the "Islands," the stream divides into numerous channels, intersecting an extensive alluvial flat, which, although almost entirely isolated from communication with the outside world, has, for many years, been the seat of a small but very prosperous farming community. The ordinary means of access to the settlement is by a very rough and often almost impassable winter-road from St. Pamphile, in Quebec, a distance of about fourteen miles; but, understanding that this road showed little or nothing of the underlying rocks, our exploratory route was chosen by way of the Big Black River, which, passing near St. Pamphile, joins the St. John, fifteen miles below the Seven Islands. Reaching St. Pamphile by the Elgin Road, the rocks of this settlement were found to be hard dark gray grits, interstratified with black slates, probably belonging to the Sillery division of the Cambrian system, and the extension of those seen on the Little Black River. Two miles west of St. Pamphile church, they form a high hill on the road to Seven Islands, but are here much coarser, becoming a somewhat schistose conglomerate, holding pebbles up to a foot in diameter, chiefly of black quartzite, with included beds, usually thin, of very lustrous black slate, the conglomerate being much veined with white quartz. Their dip is N. 15° W. < 75°—80°. The

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finer beds are quite similar to some to be hereafter noticed as occurring along the line of the Temiscouata Railway at St. Louis de Ha! Ha!, and are certainly Lower rather than Upper Silurian, as represented in the map of Mr. Richardson. Conglomerates and slates, similar to the Big Black River, above, are again seen on Big Black River, where this is crossed by the Seven Islands road, and for a quarter of a mile below. About half a mile north of the boundary, these are followed by other slates of dark gray colour and weathering bluish, which are also well exposed directly on the boundary, showing a regular and distinct dip N. $< 80^{\circ}$ — 90° . These slates are without conglomerates, are even-bedded and fissile, with thin layers of sandstone, and might readily be taken for Silurian strata; but, after prolonged search, we failed to find any fossils in them, and are, therefore, uncertain whether they should be referred to this or to some older horizon.

The difficulty here referred to of distinguishing between Silurian and older rocks in this section, and which was the main object of its exploration, is the same as that found in the Eastern Townships, and which originally led in that section to the reference of large areas, including important gold bearing districts, to the Silurian, whereas, as has been shown by Dr. Ells, these are largely, if not wholly, of Cambro-Silurian and Cambrian age. In our further exploration of the Upper Route St. John, having this separation in view, the route followed was by way of the Big Black to its junction with the St. John, the ascent of the latter to the Seven Islands and beyond to the Forks, the ascent from this point of the South-west Branch for twenty-five miles to Baker Lake, and after returning to the Forks, a similar ascent of the Northwest Branch, whence, by way of its main tributary, the Daaquam, access was had to the settlement of St. Magloire in Quebec.

The Big Black River, south of the boundary, shows but few exposures, such as occur being of slates, apparently of Silurian age. The rocks occurring between the mouth of this stream and the Seven Islands have already been described. Two miles above the Islands, gray, bluish-weathering and somewhat sandy slates occur, with a south-west strike and nearly vertical dip, and thence follow the course of the river for several miles, forming low bluffs upon its shores. Six miles above the Islands the slates are more micaceous than below, though never assuming the aspect of true mica-schists. Their dip here is S. 5° E. $< 70^{\circ}$. Ten miles above the Islands alternating slates and fine sandstones, here only slightly micaceous, dip S. 25° E. $< 70^{\circ}$. Passing Burnt Land Brook, which is eighteen miles above Seven Islands, the land becomes low and the ledges fewer, but such as occur present no noticeable difference as compared with those seen lower

down, except perhaps in the fact of their frequently holding white quartz veins. Five miles below the Forks the right bank shows ledges of hard, gray, micaceous sandstones, alternating with fine, fissile, dark-gray slates, and having a regular dip S. 12° E. $< 80^{\circ}$. Approaching the Forks the stream becomes more rapid, and is filled with large boulders, one of them thirty feet long by thirty feet high, of greenish serpentinic rock, with others of conglomerate and hard sandstone. Above the Forks, on the South-west Branch, the stream for several miles shows only dead-water, and no exposures occur as far as the

Baker Brook. mouth of Baker Brook. On this latter stream an exposure is found three miles up, of bluish-gray slates and sandstones of the ordinary Silurian type, dipping S. 25° E. $< 80^{\circ}$, but with this exception no rocks *in situ* are visible as far as the outlet of Baker Lake, the limit of our exploration in this direction.

N. W. Branch
St. John
River.

Fossils.

Returning from Baker Lake to the mouth of the North-west Branch, the latter was then ascended, with the opportune aid of heavy rains, to its forks or point of confluence with the Rivière Noire, a small stream flowing south from Lac de la Frontière. This stream we ascended, but with great difficulty, to a point about one mile below its first falls, and three below the lake and boundary. Here occur good exposures of fine-grained, gray sandstones, slightly micaceous and alternating with slates, and in these were found the only fossils met with in any portion of this region. These consist of long, coarsely and longitudinally furrowed stems of plants; but though occurring in considerable numbers they are not sufficiently preserved, or of such a character as to throw much light upon the age of the containing beds. These strata have a distinct and regular dip S. 10° E. $< 80^{\circ}$, and their general aspect is not unlike that of many Silurian beds, but in view of the observations made by others in this vicinity (See Report for 1887, part K, page 13) we are not prepared to say

that they may not be older. In an examination of this region made by Mr. A. Webster, formerly of the staff of the Geological Survey, and referred to in the report last cited, similar slates and sandstones are described as having associated with them beds of dark gray graphitic limestone, but these are situated somewhat nearer to Lac de la Frontière, and owing to want of water, were not reached by us. The whole series is regarded by Dr. Ells as Cambro-Silurian. On the Daaquam, as far as ascended, viz., to a point where this is touched by the clearings eight miles south-west of St. Magloire, no exposures of any kind were observed.

It will appear from the above observations that so far as the main issue is concerned, viz., the separation of the Silurian and older strata,

These show nothing of a decisive character by which the question may be determined. Admitting that the beds observed upon the Rivière Noire, and possibly those near the boundary upon the Big Black River, are older than Silurian, though the character of the plant remains upon the former is rather unfavourable to this view, we cannot but think that the exposures in the main valley of the St. John, and as far up as Baker Brook, are of Silurian age. At least they do not differ essentially in character from those which occur so widely lower down in the same valley, and which all the facts in our possession tend to refer to that horizon. It may here be observed that the character and relations of these latter rocks are strongly marked in the physical features of the region, as strikingly seen in ascending from the valley of the Daquam to the settlements south-west of St. Magloire. The land here rises rapidly and from a high hill, two miles and a half from the river, one may look back over the valley and for many miles follow its course north-easterly and south-westerly as a low tract of nearly level land, along the southern side of which, at a distance of ten or fifteen miles, is another chain of somewhat prominent hills, probably the westward extension of the Aroostook Mts. from the sources of the Alleguash River. It may be added that as a matter of practical cartography the question, so far as Canada is concerned, is, after all, of little importance, as it is probable that the Silurian rocks, if such they are, are almost wholly confined to the region south of the Canadian boundary.

CAMBRO-SILURIAN.

According to the arrangement of Dr. Ells, referred to in the introduction, and which has been here adopted, the rocks regarded as Cambro-Silurian embrace (1) those which, as best exhibited in the vicinity of Point Lévis, consist of blackish green and gray shales, carrying a characteristic Ordovician fauna, with which are associated dolomitic limestones and limestone conglomerates, the whole described as resting in synclinals of the underlying Sillery or Cambrian formation; and (2) the overlying black bituminous shales and limestones, including the rocks of the Citadel of Quebec, which carry faunas ranging from the Trenton, through the Utica formation, to the age of the Hudson River or Lorraine shales.

Of these several groups of rocks we are unable to say with certainty that any occur within the district to which this report relates. As regards the fossiliferous limestones and shales, however, of the Trenton-Utica formation, which are so conspicuously developed upon the north shore of the St. Lawrence at Montmorenci and elsewhere, it may be

Trenton-
Utica pro-
bably absent.

considered as quite certain that nothing resembling these is to be met with on the south shore, at least within the settled portions of the area examined by us. The fact, however, that such strata do occur, only a few miles farther east on the Gaspé shore, near the mouth of the Tartigo River (see Report of 1880-81-82, page 30 *op.*) where they are infolded among the Cambrian strata, would make us hesitate to say that such beds, similarly infolded, may not occur over the large and to a great extent uncleared tract embraced in this report. It may, however, be observed that these rocks, whose nature, when present, is so readily recognized, are equally absent from the drift, a circumstance which renders the fact of their occurrence extremely improbable.

Quebec
Citadel rocks.

As regards what has been termed the Quebec Citadel series, also consisting of black bituminous shales and limestones, with some conglomerates, but holding a fauna in some respects distinct from the typical Trenton-Utica formation, we have also failed to recognize its presence over any portion of the area examined by us. The occurrence, however, of some of its peculiar forms in the strata revealed in the valley of the Beccaguimic River in New Brunswick would seem to indicate that the group is more than a local one, and that similar remains may yet be found at some points over the wide area by which these two localities are separated.

Lévis group
nowhere
recognized.

The lowest rocks of the Ordovician or Cambro-Silurian, as here classified, are those of the Lévis group proper. Of their occurrence or absence within the area under discussion, we feel unable to speak with any great degree of confidence, for although particular groups of strata are sometimes there met with, which in lithological aspect might well be compared with the typical beds as seen at Lévis and the south-west end of the Island of Orleans, careful search has as yet failed to reveal any fossils which are sufficient to establish their identity, while the extreme complexity of arrangement, as revealed along the coast, together with the want of good exposures in the interior, make the study of the stratigraphy, and the identification of particular horizons exceedingly difficult. Under these circumstances it only remains for us to describe the various formations of the entire area, as they have been actually observed, which may be most conveniently done in connection with the consideration of the Cambrian system, to which undoubtedly the great bulk of the strata belongs.

CAMBRIAN.

Prior to the publication of the present report, the most important references to the area now to be described are those contained in the "Geology of Canada, 1863," and the subsequent report of Mr. Richard-

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son in 1868. In the first of these publications the references are almost entirely confined to the settled areas, immediately adjacent to the St. Lawrence; but in the latter the various groups distinguished in the vicinity of Quebec are traced eastwardly, and both described and mapped as to their supposed relations along the section afforded by the Temiscouata Portage road. The subdivisions recognized included not only the Sillery, Lauzon and Lévis of the earlier reports, the latter being regarded as the lowest, but also a group referred to the Potsdam, and further subdivided into three divisions. The reasons for this latter view, and for its abandonment by later observers, are fully given in the report of Dr. Ells for 1887-88 (part II., page 42 K), and will be further noticed here.

The Temiscouata section is by far the most complete of any to be found in the district. Indeed, with the exception of that afforded by the Intercolonial Railway between Metapedia Lake and Metis, and that of the Pohenegamook road, it is the only accessible line of traverse across the entire belt of Cambrian rocks in this part of Quebec. While, however, that of the Intercolonial covers a breadth of only about eight or ten miles, that of the Temiscouata road embraces a distance of over forty. The recent opening also of the Temiscouata Railway having afforded, in its cuttings, admirable facilities for the examination of the rocks which it intersects, these have been carefully studied, and will be here made the basis of comparison for the entire region.

The north-eastern part of Lake Temiscouata is occupied by a series of rocks, briefly referred to in the Geology of Canada, 1863, as belonging to the base, *i. e.*, to the "Lévis" division of the Quebec group, as then understood. As seen on the south-east shore of the lake, above Mt. Wissick, they consist of gray and dark gray fissile clay slates, holding thin interlaminated beds, from two to four inches thick, of hard gray sandstone and, at the foot of the eminence named, are (as described in the Report of 1887-88, part II., page 29 M) covered unconformably by the fossiliferous limestones and sandstones of the Silurian system. In these slates, which, in contrast with the rocks of the mountain, are highly tilted and corrugated, we have, during the last summer, succeeded in finding fossils which, for the first time, afford definite evidence as to the age of the beds containing them. These, in addition to obscure Lingulæ, include undoubted specimens of *Obolella* (or *Linnarsonia*) *pretiosa*, Billings. As this species is not only characteristic of the Sillery group, as here understood, but confined to it, its occurrence may be regarded as showing the equivalency of these beds to those which on the Chaudière,

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Sillery fossils.

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Fibrous lime-stone bands.

at St. Michel, on the St. Lawrence, and elsewhere, contain the same form, and which are regarded as representing the upper member of the Cambrian system. Some portions of the slates are banded with numerous thin layers, from one to four inches wide, of light gray, yellowish-weathering limestone, having a peculiar transverse fibrous structure, and from this feature have been compared (Geology of Canada, 1863) with the rocks of the Chatte River, on the north side of the Gaspé peninsula. They are thought by Dr. Ells, who has personally examined them, to probably represent Divisions 2 and 3, of the section given by him as occurring at Cap Rouge, near Quebec.

White sandstones.

It should be added that in Cabano village, at the foot of the northern section of the lake, and in the line of strike of these beds, is exposed a heavy mass of white vitreous sandstone, which may be a part of the same series. It is, however, completely surrounded by fossiliferous Silurian slates, and it has been found impossible to determine whether it pertains to the older series, protruding through these slates, or is the equivalent of very similar sandstones, which at Mt. Wissick occur near the base of the Silurian.

Flaggy lime-stones.

Strata similar to the above occur for some distance along the south-eastern side of the lake, corresponding approximately to its course, and again upon its north-west side; but here, as seen just above Sandy Point, the included limestones are flaggy, breaking in broad slabs, the fracture of which is conchoidal, while the unequal hardness of the calcareous and slaty layers gives, by weathering, to some of the beds, a gnarled or ribbanded appearance. The tops are irregular, in some places north-westerly, in others south-easterly, at varying angles. It is probable that they occupy the whole of the low ground, a mile or so wide, on the north-west side of the lake, and in their westerly extension underlie the similar low tract crossing the Temiscouata Railway and Portage road, between Cabano and the 37th mile post. Further west, the same beds have been observed on the Cabano River, three miles above its mouth, whence they probably cross to the foot of Boundary or Pohenegamook Lake. In an easterly direction, owing to the uncleared state of the country, it has been impossible to trace them; but it is probable that they are at no great distance overlapped by the Silurian strata which in this direction sweep northwards towards the St. Lawrence.

Where the Temiscouata road crosses Little River or Rivière du Lac, near the 38th mile post, are fine, gray and dark gray, somewhat plumbaginous slates, seamed with spar, which probably form a part of the belt last described. Just north of this the land begins to rise, and on the slope of the hill between the 37th and 38th mile-posts,

in the same member of the same bedded with light gray, dense fibrous Geology of the north side, who has layers 2 and 3, near Quebec. At the foot of the same beds, is which may be a rounded by able to determine through these which at Mt. St. Louis de la Rivière du Loup.

From the south to its course, above Sandy Head slabs, the hardness of the beds, regular, in some angles. It is a mile or so westerly extending to the St. ^{Montreal} Railway. Further River, three at the foot of the section, owing to the overlapped northwards.

Rivière du Loup, somewhat from a part of the margins to rise, in mile-posts,

beds of reddish-gray and purplish-gray sandstone, associated with bright red and gray, sometimes greenish slates, come into view, dipping south-easterly at a high angle; beyond which are broad ledges of gray, very siliceous white-weathering sandstones, also dipping southerly, though with some irregularity. The slates are supposed to represent Slates and Divisions 2 and 3 of the Cap Rouge section, or Lower Sillery, while the sandstones of the Sillery, the quartzites, which are in two or more bands, separated by belts of slate, are referred to Division 4.

From the 37th mile-post the road, for half a mile, runs on the strike of the sandstones, now dipping north-westerly, beyond which more bright red slates (2-3) appear. The quartzites thus mark an anticlinal, Anticlinal. flanked on either side by the red slates. To these succeeds a broad belt of dark gray to black crumpled slates, which occupy the greater part of the space to the church of St. Louis de Ha! Ha! Here another great ridge of white-weathering quartzite comes into view, dipping S. 60° E. $< 50^{\circ}$, while at the base of the ridge on the northern side are found large, loose blocks of limestone-conglomerate, of which Blocks of limestone conglomerate the pebbles in some instances resemble corals, but appear to be only concretionary. These are the only rocks met with in the interior which bear any resemblance to the limestone-conglomerates, so strikingly represented on the shores of the St. Lawrence, but the beds from which they were derived could not be discovered, and their precise relations are therefore unknown.

The rocks last described occur in the valley of the Rivière des Savannes, half a mile south of mile-post 34. It may here be remarked that it is at this point that, in the map of Mr. Richardson, the rocks of the Quebec group are represented as followed by the Silurian system, occupying all the area above described; but from the descriptions given it will be evident that the true southern limit of the Cambrian is several miles further south, or about the Cabano River. In the same map the rocks from the 34th to the 26th mile-post are represented as belonging to the Lévis group. As first seen to the north of the 34th mile-post they consist of dark gray, glossy slates and slaty sandstones, which are much corrugated and stained with white quartz. They rise into very prominent hills, including White Mountain, Mount Prominent Paradis and others, and from the summit of these may be seen to hills. form a well marked ridge, extending eastwardly towards the head of Temiscouata Lake. Some of the slates are greenish, others purplish and black, with seams of quartz and chlorite, and their dip, as seen on the northern side of the ridge, is N. 25° , W. $< 70^{\circ}$. Very similar beds have also been observed on the shores of Boundary or Pohenegamook Lake, eighteen miles to the westward, and it is probable that the

Small areas
possibly Pre-
Cambrian.

ridge is continuous in that direction. In some respects these rocks appear to be older than any seen elsewhere in this section, and recall some of the strata which in southern New Brunswick underlie the lowest Cambrian rocks, as they do also contain other beds which, near St. Magloire, in Quebec, have been similarly referred to a Pre-Cambrian horizon. They cannot, however, here be clearly separated from the undoubtedly Cambrian strata, and apparently form one series with the latter.

Fine con-
glomerates.

The slates or schists referred to have a width of something over two miles, but owing to the course of the road, which follows the valley of Blue River, occupy most of the space between the 34th and 29th mile-posts. Near the latter the cuttings on the railway are partly through slates of gray, green, purple and black colours, which are very glossy and unctuous, and partly through gray quartzose sandstones and grits, which sometimes become fine conglomerates, and are filled with numerous fragments of black, glossy slates. The latter rocks are in all probability representatives of Division 4 of the Sillery group, and forcibly recall the grits of the latter as seen near the forts in the rear of Lévis.

Blue River
valley.

At the mill on Blue River heavy beds of white-weathering quartzite again come into view, and are seen to inclose thin beds of fine, fissile, glossy slate, while above them are about one hundred feet of black slate, containing thin beds of quartzite, from one to two feet thick, the dip of the whole series being N. 20° W. < 65°. Beds of similar character appear on the slope of the hill south of St. Honoré, and form also conspicuous ridges for several miles, both east and west of the Blue River valley.

Highest land.

The church and settlement of St. Honoré mark the highest point on the traverse from the valley of the St. John to that of the St. Lawrence, and have an elevation above the sea level of 1,400 feet. The actual water-shed, however, as indicated by the position of Lake St. Francis, whence the stream of the same name flows to the St. John, is nearly nine miles further west, or is within twelve miles of the St. Lawrence. The country about St. Honoré though high, is comparatively flat, showing only gentle undulations, and is covered with a clayey soil containing but few boulders. Rock exposures are also few, and their character indecisive. Near the southern part of the plateau and settlement are gray white-weathering sandstones, resting on black slates, similar to those in the valley of Blue River; while at the 26th mile-post, are dark gray glossy slates, with a high dip, but much corrugated. These latter have been regarded by Dr. Ells, from their lithological aspect, as being below the quartzites and associated strata, and

Water-shed.

Anticlinal.

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as marking a Lower Cambrian anticlinal. It is quite probable that this may be the case, but the exposures, which are only a few yards in extent, are not sufficient to allow of their relations being determined with certainty.

The descent from St. Honoré, on the northern side, is less rapid than upon the southern, and for the most part, the country is less rugged. For three miles and a half from the station there are no exposures, either on the road or railway. Half way between the 23rd and 22nd mile posts, the latter intersects the former, and just beyond the crossing, are cuttings in black, shining flaggy slates, holding thinner bands of green and purple slates. Their dip is distinct, N. 33° W. $< 70^{\circ} - 80^{\circ}$. A quarter of a mile further on is another cutting in dark gray grits, dipping S. 30° E. $< 80^{\circ}$. These latter contain little black grains of quartz, together with fragments of black slate, and are supposed to be a repetition of the rocks already noticed at Blue River, and like the latter to represent Division 4, or the Upper Sillery of the Cap Rouge section. From this point on, for several miles, or as far as the St. Francis River, the railway cuttings are frequent, the prevailing rocks being slates, some of them bright green, purple or red, while others are dark gray to black, and glossy. They include, however, some beds of dark gray grits, and one small ridge of white-weathering sandstone. The dips are, as usual, irregular, but mostly to the southward, varying from S. 30° E. $< 80^{\circ}$ to S. 10° E. $< 90^{\circ}$. They are the strata which, on Richardson's map, are referred to the "Lauzon," forming a portion of a belt extending, with great uniformity, and with an average width of about four miles, all the way from the Chaudière River; but in the classification here followed, are referred to Divisions 2 and 3, of the Sillery group.

To the above belt succeeds a tract, nearly six miles in width, being the greater part of the space included between the St. Francis and the head of Rivière Verte, in which there are but few exposures, but where such as occur, are very generally of a dark green grit, the characteristic rock of the Sillery, large loose blocks of which are also thickly strewed over the entire area. This belt is also continuous for many miles to the westward, and on the Pohenegamook road, according to Richardson, has a breadth of about eleven miles. To the eastward, its distribution is limited, and in a traverse made by one of the authors by way of Trois Pistoles to Lake Temiscouata, it was found that no continuous belt of these sandstones crossed the line of section.*

Lauzon of
Richardson.

Belt of dark
green grit.

To the eastward the nearest section to that of the Temiscouata road is afforded by the road to St. Hubert which leads by St. Epiphane and

*Annual Report, vol. III., pp. 26, 27, 28 M.

Band of Sil-
lery grits
terminates.

St. Francis between which two points, if prolonged on its strike, the band of Sillery grits would pass. Though the distance across to the Temiscouata Road, where the band has a width as already indicated of about six miles and a half, is only ten miles, no trace of this broad band of grits is to be found. It is true that isolated exposures of the greenish grit are seen, but these seem to represent here as over the whole eastern portion of the area under consideration, only lenticular patches inclosed in the prevailing red, green and gray slates. The band, therefore, must rapidly diminish in width as it is followed eastward from the Temiscouata Road, until at a point a little to the east of the eastern end of Lake St. Francis, it entirely disappears as a distinct band and is only represented by the small inclosed areas already alluded to.

Complexity of general structure.

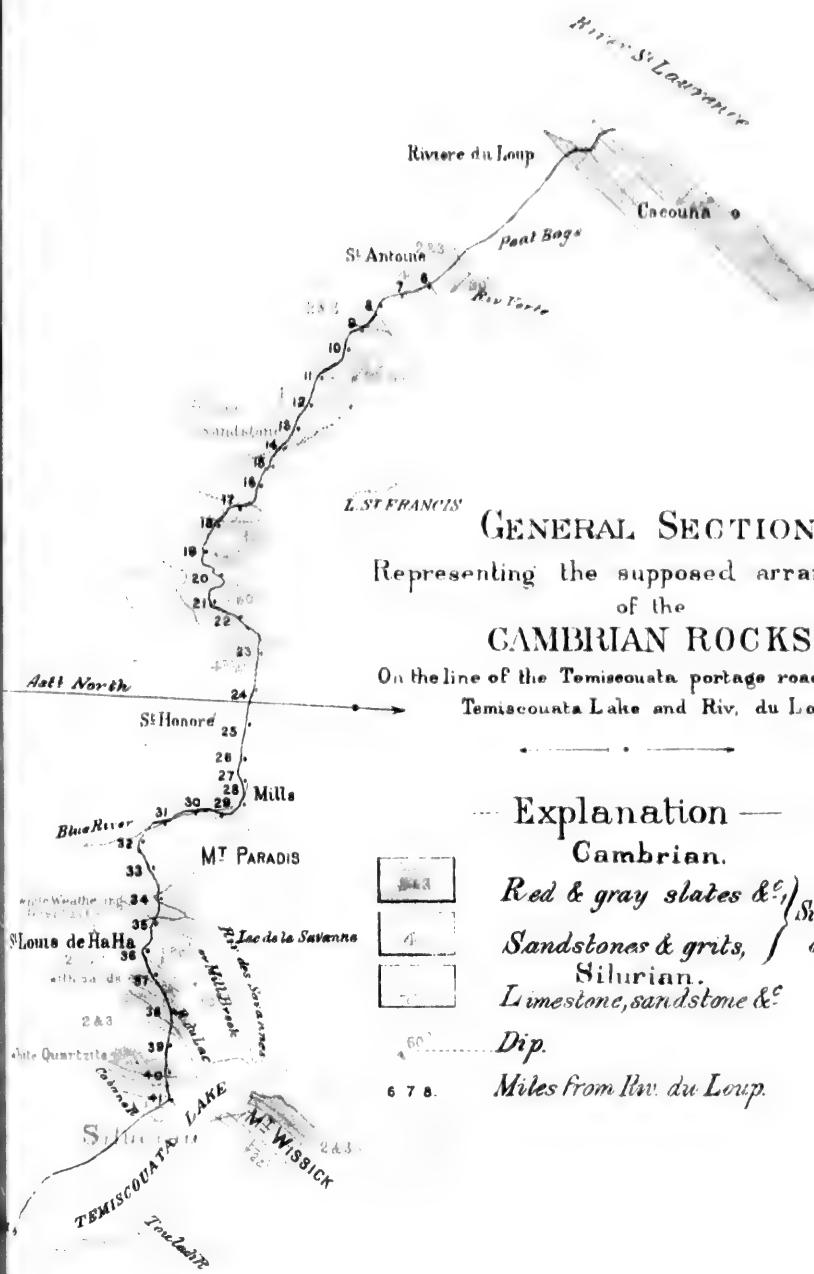
On several of the roads and streams further to the east good sections across the strata may be seen and in each of these though the general structure is the same, the details are quite different so that no general division of the strata into well-defined bands is possible. In fact it would be only on a large scale, lithological coloured map that any divisions could be mapped in the whole complex of rocks stretching from the St. Lawrence southwards to the overlying edge of the Silurian system. In the case of these Sillery sandstones as seen over the whole of this easterly area the prevalence of southern dips is noticeable and would seem to indicate that the strata have been effected by a thrust acting from the south-east and buckling up the

Thrust faults. beds towards the north-west in overturned anticlines. These overturned form ridges whose steep northerly sides represent in many cases lines of local thrust faults, the beds having been pushed from the south-east and overlapping by a short slide. A fault on a larger scale but of similar character to these small local thrusts would explain the structure at Mount Wissick on Lake Temiscouata, where the heavy beds of Silurian sandstone which make up the main body of the mountain, and which hold a fauna indicating for them a Lower Helderberg age, are found overlying at a comparatively low angle the highly contorted and twisted slates of the Sillery and succeeding the steeply inclined beds of conglomerate and shale of Black Point and its vicinity, while fossils indicate that they are of about Niagara age. A thrust fault of the character above indicated would very well account for this structure, and the moderate dips of the overlying beds contrasted with almost vertical position of those of Black Point is perhaps to be more easily explained in this way than by supposing that we have here an unconformity between two parts of the Silurian, with an upthrust fault.*

Structure at Mt. Wissick.

*Cf. Annual Report, vol. III., part II., page 35 M.

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These overturn folds with prevailing southerly dips, are very common structure. in the case of the Sillery sandstones all over the area now being considered, and presumably the slates have been effected in the same manner, though, owing to their being more profoundly crumpled, and often locally bent and twisted, the structure is not so well defined in them as in the more resistant sandstones. The sandstone exposures cannot be traced in continuous belts for any great distance, partially owing to the profound folding to which the strata have been subjected, but more, probably, to the fact that the sandstones have been originally deposited only in lenticular areas alternating with patches of slates, the sandstones being laid down only where the conditions were favourable for their deposition, these conditions being the same as those which, along the present coast line, cause the alternation of long sandy beaches and extensive mud flats. About twelve or thirteen miles from Rivière du Loup, the band of green Sillery sandstones, last described, is followed by another belt of red, purple and green slates, well exposed near a fall and lumber dam on a branch of the Rivière Verte. They are evidently members of Divisions 2 and 3, being a repetition of the beds at the head of the St. Francis, and mark the northern side of a synclinal, of which the sandstones (Division 4) occupy the centre. The dips, as usual, are southerly, but very variable in their angles sometimes not exceeding 8° or 10° . Half a mile beyond the crossing of the Rivière Verte, Rivière Verte, rocks, similar to the above, occur, but, at the 8th mile-post, are succeeded by black rusty-weathering slates, which are the only rocks visible for over a mile. These, on the map of Mr. Richardson, are represented as the second division of the Potsdam, while to Division 3, of the same group, is referred a series of grits and sandstones which, in the neighbourhood of the 6th and 7th mile-posts, border these slates on their northern side, being well exposed at a mill on another branch of Rivière Verte. We were unable to find any fossils in the slates, but there is certainly nothing about the sandstones which would indicate that they are others than those which, at so many points, form a characteristic member of the Sillery series. They probably mark another anticlinal, similar to those of St. Louis and Anticinal, Blue River, and, as at the latter, are immediately followed northward, at St. Antoine, by another wide belt of (Lauzon) red shales. This is about five miles from Rivière du Loup station, within which distance the country is flat and largely covered with barrens.

The general arrangement of the rocks along the line of the Temis-Plan. couata Portage, above described, will be better understood by reference to the accompanying plan, in which, however, all minor details are omitted.

Lenticular areas of sandstone.

Earlier
reports.

The rocks about Rivière du Loup have been prettily fully described in the Geology of Canada (1863) and again in Mr. Richardson's report (1867). To these descriptions we have but little to add, except to say that we are quite unable to see any reason for the separation of any of these beds, as Potsdam, from other portions of the Cambrian series. The extremely complicated, not to say unnatural arrangement of the strata caused by the introduction of this designation, with its subdivision into three distinct groups, as made by Mr. Richardson, will be very greatly simplified if only we admit the identity of the sandstones

Frazerville
grits probably
Sillery.

and grits of Frazerville with those of the Sillery formation, as already described along the Temiscouata section, and as they occur in the vicinity of Lévis. Certainly they cannot be distinguished lithologically from the latter, and their relations to the associated strata would seem to be quite the same. These, as seen at Rivière du Loup station and at the High Falls, are dark gray green and red shales, with bands of gray quartzose sandstone and gray arenaceous limestone, representing Division 3 or the Upper Cambrian; and the strata of limestones and shales, of similar character and colour which appear at Rivière du Loup Point and along the road to Cacouna, and which were described by Richardson as Division 3 of the Potsdam, are, no doubt, these same beds coming up from beneath the quartzites on their north-west side. Thus the sandstones and grits of Rivière du Loup, or rather of Frazerville, represent another synclinal, and as such extend eastwardly to the mouth of Isle Verte.

Synclinal.

Outside of the red and gray slate belt which extends through Cacouna to the mouth of the same river, another broad synclinal is represented in the rocks of Cacouna Island. The principal features of difference in the rocks of the Cambrian system as seen along the coast, in comparison with those of the interior, is the occurrence here of limestone conglomerates, interstratified with the red and green shales, and which like the associated limestones, are more or less fossiliferous. During the past summers a re-examination of the localities observed by Mr. Richardson, as well as others, have been made by us, but without adding any new information to that obtained by him. The following notes upon this subject and upon the rocks occurring along the coast eastward to St. Fabien are based on observations of Mr. McInnes. As above observed, the rocks which seem most worthy of a special description in connection with the Cambrian of this region are the extensive deposits of limestone conglomerate.

Limestone
conglomerate

These conglomerates occupy a comparatively narrow belt along the present coast line. They are nowhere found at any considerable distance inland, but form long ridges parallel to one another and to the trend of the shore. These ridges are often the sides of long

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synclinal axes or the crests of anticlinals, and sometimes merely small whale-back areas protruding through the inclosing slates. They can perhaps be best seen about the village of Bic and westerly along the coast between that point and Trois Pistoles. The irregular coast line, so striking a feature along this part of the south shore, and, indeed, the harbour of Bic, are due to the occurrence of these hard conglomerates alternating with the softer Sillery slates. The tides and currents of the river have washed deeply into the soft shales, and left the hard conglomerates projecting in bold points with irregular and striking outlines. A short description of the rocks seen along the shore from Rimouski south-westerly up the coast will perhaps best give an idea of the mode of occurrence of these beds. Occupying the shore all along coast section. as far as a point about three miles above Sacré Cœur de Jésus are gray slates, cleaved obliquely to the bedding, and showing prominent bandings of red, green and purple. The strike of these slates, though showing considerable local curving and twisting, yet follows one general direction parallel with the coast line, the rocks standing at angles of from 70° to 90° . Above this point the coast is bordered by high bluffs of conglomerate, rising in bold cliffs, often almost perpendicularly from the shore. These conglomerates immediately overlie the slates already described, which still continue to form the flat shore at the base of the cliffs. The cliffs are formed of a coarse conglomerate, which is overlaid by a finer conglomerate and sandstone, which passes upwards into a still finer sandstone or quartzite. This general order of beds is preserved all along the shore the coarse conglomerate, whose nature is calcareous and sandy, and among whose pebbles are many of a tolerably pure limestone, occupying a middle place between the overlying finer conglomerate and sandstone and the variously coloured slates below. These underlying beds are the typical Sillery slates which, at different points along the coast, hold *Obolella pretiosa*, etc.* These conglomerates are remarkable, particularly for the interesting assemblage of pebbles which they contain, which are for the most part of a character quite distinct from any rocks occurring in place anywhere in the neighbourhood. One of the commonly occurring pebbles, often found of very large size, is of a bright gray or drab, fine, even-grained limestone of fair purity—pure enough to have been burned successfully for lime. A limestone very similar to that forming these boulders occurs at Lake Mistassini and about the shores of Hudson's Bay, but as far as our knowledge goes at no point nearer.*

Conglomerates
overlying
Sillery slates.

Variety of
pebbles.

*Annual Report, 1885, p. 32 D.

Fossiliferous
pebbles.

Pebbles of a very distinctive limestone, literally crowded with comminuted fossil remains. *Obolella*, *Lingulella*, etc., also occur in considerable numbers. No limestone of a similar character is known nearer at hand than at the Straits of Belleisle, but there beds of so remarkably similar a character are found that it seems probable that the pebbles under consideration have been derived from these beds or rather from a former westerly extension of them.

Diorite and
conglomerate
pebbles.

There occur also pebbles of a hard amygdaloidal diorite which differs from anything known to occur in the district, and representatives of an older conglomerate, sandstones and quartzites with occasional schists whose derivation does not seem to be so remarkable, though even they are not represented in the neighbourhood by rocks of an exactly similar character.

Derivation
of pebbles.

That the beds from which the bulk of these pebbles have been derived nowhere underlie the conglomerates in this district is fairly certain. The complicated folding which has affected all the strata of the region must bring into view at some point representatives of all of the immediately underlying rocks, and beds so conspicuous in their macroscopical character as the two limestones above referred to could hardly have been passed over in a district which is now largely cultivated back nearly to the overlap of the Silurian system.

Absence of
Laurentian
pebbles.

Another point of interest in reference to these conglomerates in addition to the peculiar assemblage of boulders above referred to, is the absence in them of characteristic Laurentian pebbles. This condition of affairs is in great contrast with the state of things obtaining at the present day. The gravel beds now in process of formation along this part of the St. Lawrence coast are made up in the main from the hard conglomerates and sandstones bordering the shore, but contain in conspicuous numbers, boulders of typical Laurentian gneiss.

Pre-Cambrian
conditions.

That none occur in these earlier gravel beds, would go to show that, at the time of their formation, the vast area of Laurentian to the north was covered by other beds. And this view is strengthened by the occurrence of limestone pebbles, already mentioned, which must have been broken from their parent rock at a time when the beds now seen only at Mistassini, Hudson's Bay, and Belleisle, extended widely over the present Laurentian floor.

Early Lauren-
tian floor.

It has been noted by various observers that the Laurentian is found with approximately its present surface contours, wherever the earliest overlying beds are seen overlapping it.*

*Note on the Pre-Paleozoic surface of the Archæan terranes of Canada, by Andrew C. Lawson, Bull. Geol. Soc. of America, vol. I, pp. 163-174.

It had then suffered very considerable denudation even at that early Formation date, and boulders must have been formed in great numbers by the uneven decay of the rock. These boulders should be largely represented in the conglomerates we have been considering, if the Laurentian was then bare of overlying rock, for, from the widely different character of its contained pebbles and boulders, it is to be inferred that this conglomerate was not formed only of material accumulated at the base of some cliff and derived from its decay, but rather has resulted from the gathering together of materials from various beds, probably widely separated. It seems then, probable, that these conglomerates were originally laid down along an extended shore line, defined, approximately, by their present distribution, for the formation of which the materials were carried down from the north by streams and rivers, which cut early Cambrian strata, which covered the present valley of the St. Lawrence and spread widely over the northern area, now denuded down to the bare gneissic hills of Laurentian.

The region between St. Fabien and Bic, and extending back to the edge of the overlying Silurian, is occupied, generally, by strata, which are quite characteristic of the Sillery, as defined in this report. There is one notable exception, however, in the case of a small area of sandstones, which occurs at Lac St. Simon, about five miles back from the coast, the exact age of which has not been determined. The following brief description of these rocks is based partly upon observations by Mr. Ord, in 1878.

Lac St. Simon sandstones.

To the south-east of Lac St. Simon and forming bluffs of moderate height along its southern shore lies a small, synclinal basin of a rather hard, quartzose, red sandstone which overlies unconformably the red and gray, highly tilted slates and sandstones of the Sillery. The basin is a very shallow one, the rocks dipping, at its western and south-western edges, east and north-east respectively at angles of 15° to 20° and all along its southern edge, north to north-west at the same low angles. The area has a width of only about a mile and a half with a length of three miles and a half. As no fossils have yet been found in the sandstone and as it overlies unconformably, in the form of a shallow synclinal basin, the Sillery formation, the only inference yet possible as to its age is that it is newer than Middle Cambrian.

That it is not Silurian seems also probable as no rocks of a similar character have been found in the Silurian which is well exposed at no great distance where it overlaps the Sillery both to the east and west. Some of the Silurian white sandstone of the basal beds of Mount Wissick are, however, near enough in character to those now under consideration to make it possible that they may represent these beds. The

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Temiscouata beds, though they do not show the deep red colour which is characteristic of large portions of these sandstone, often have their generally white colour tinged strongly with pink or light red.

Building
stone.

At the time of the building of the Intercolonial Railway this rock was quarried quite extensively for bridge-building purposes and seems to have served admirably this object and it may be considered both from its texture and colour as a building-stone of value. Though an actual contact between these sandstones and the underlying Sillery was nowhere seen by the writer, yet there can be little doubt about the structure. The hard Sillery quartzites which run under the sandstones in east and west trending ridges have a general dip varying from 45° to 90° , while the sandstones themselves in no case show a higher dip than 20° and flatten out from that attitude to horizontal.

Fossils.

The interval between St. Fabien and Bic is especially remarkable for the great development of the limestone conglomerates. The pebbles of these conglomerates contain fossils of Primordial age, especially *Olenellus Thompsoni*, and the associated shales which are of various colours hold obolellas and graptolites, but these latter do not appear to include any Lévis forms, and are regarded as marking a Lower or Upper Cambrian (Sillery) zone. The conglomerates are conspicuously exposed along the railway, between three and four miles west of Bic station and again on either side of the entrance of Bic Harbour, in each case resting on the shales, and themselves covered, at least on the southern side, by beds of white-weathering quartzite. The dips are very irregular and low undulations are sometimes seen, while in addition to the main belts of conglomerate other smaller and lenticular bands occur at various points around Bic Harbour.

Width of
Cambrian belt

Near Rimouski the width of the Cambrian belt becomes greatly reduced, the overlapping Silurian approaching on the Rimouski River within a distance of seven miles from the St. Lawrence, and then sweeping around by St. Blondin and the valley of the Neigette to the Grand Metis River. As seen on the road to St. Blondin and at the lower falls of the Rimouski, the rocks are similar to those of Rivière du Loup, consisting chiefly of slates of red and gray colours, sometimes beautifully ribbanded, and holding thin bands of limestone. Similar beds also skirt the shore in front of the town of Rimouski, and thence towards St. Anaclet and Father Point. In this vicinity the width of the Cambrian belt is still quite narrow, the distance from the shore to the Silurian escarpment overlooking the valley of the Neigette on the southern side being not more than eight miles, but a short distance to the west it rapidly widens, and embracing the western extremity of Mount Commis sweeps around to the Rivière

Northern edge
of Silurian at
Neigette
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Rouge, a branch of the Metis, near where this is crossed by the Taché road. Mount Commis itself is partly composed of trap (dark gray and purplish epidotic and vesicular diorite) and in part of coarse grits and quartzites resembling those of the Sillery. The latter are a part of a belt which crosses the Rouge and reappears on the Taché road, just west of Ste. Angèle; while both north and south of this sandstone belt are belts of red and green slates, with thin bands of limestone and limestone conglomerate, the characteristic rocks of Division 3.

Another wide belt of these Upper Cambrian Sillery sandstones runs ^{Grand Metis} south of and parallel to the Neigette River and crosses the Grand Metis not far above where this is crossed by the Intercolonial Railway, being largely used in the construction of the culverts and bridges of the latter. Still farther south, near the mouth of the Grand Metis, are at least two other belts of Sillery sandstone, extending westward in the direction of Ste. Flavie, and separated by parallel belts of very coarse limestone conglomerate and dark gray shales. The breadth of the entire group upon the Grand Metis is about sixteen miles.

The last point to which our examinations upon the coast have extended is that of Little Metis Bay. For several miles from Grand Metis the shore shows only Quaternary deposits and is strewed with Laurentian boulders, mingled with a few of fossiliferous Silurian limestone, but, beyond this point, gray shales, banded with purple, come into view, and may be followed for a considerable distance, their general dip being southerly at high angles. Approaching the Light-house heavy beds of gray sandstone come into view, often with reversed dips, and run out to the promontory on which the Light-house stands. From this point to the mouth of the Little Metis the trend of the shore is nearly at right angles to that of the measures, and hence a section is revealed which is one of the most complete to be met with anywhere along the coast. It is also very interesting as containing the beds in which the remains of fossil sponges were found by Dr. Harrington in 1887, and subsequently more fully collected and determined by Sir William Dawson. As the section, with its ^{Fossils.}

Little Metis
Bay Quater-
nary deposits.

Probable age. much like those of the beds at Grand Metis and again at Bic, probably occupy about the same horizon.

Railway cut-
tings ex-
amined.

In the rear of the district last noticed, and about the sources of Little Metis River, the Cambrian area is traversed by the Intercolonial Railway; and between Little Metis Station and that of Saint Moïse long and deep cuttings have been made. Unfortunately for the present examination the greater part of these are covered with snow-sheds which almost completely exclude the light, and a satisfactory examination of them is difficult. The longest cutting, exceeding

Little Metis. mile, occurs at and just south of Little Metis Station, and is chiefly dark gray slates, dipping southerly. A quarter of a mile further south another cutting shows gray glossy slates and shales exhibiting several archings, but also for the most part dipping southerly. The next long cutting is also in shales, mostly gray, but including others of purple colour. Still another shows purplish red shales, often splintery and with alternating beds of gray, the whole lying in a succession of large folds. To these succeeds a band of coarse gray grit containing numerous pebbles of white quartz, mingled with many of black slate, and which no doubt, represent the Sillery sandstones of Division 4, the beds previously mentioned being those of Divisions 2 and 3. The dip of the sandstones is northerly, and on their southern side they are immediately underlaid by bright red slates, showing beautiful archings. A quarter of a mile further south more bright red slates occur, alternating with coarse gray grits, and showing great irregularity of attitude, and then after a similar distance a long cutting in dark gray, black slates and shales, probably a repetition of those at Little Metis Station. This cutting is about one mile north of Berniers, with which interval there are no exposures; but south of Berniers, which is five miles south of Little Metis, and thence to St. Moïse, bright red beds again predominate, mingled with others of gray and dark gray tints.

Berniers to
St. Moïse.

Between St. Moïse and Sayabec the Cambrian is unconformably overlapped by the Silurian and the area examined by us meets that of the Gaspé region explored and mapped by Dr. Ells.

St. Moïse to
Sayabec.

Geolo

ALFRED

V and M. Jones.
1889 - 1890.

EVINCE OF Q

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Compiled and drawn by Wm. M. Jones from a compilation by Scott Barlow, and from Railay Crown Lands and Geological Survey Plans, and from Tach's map of Quebec. Geographically re-surveyed by L. W. Bailey and W. M. Jones in 1888-1889.

17, N.E.

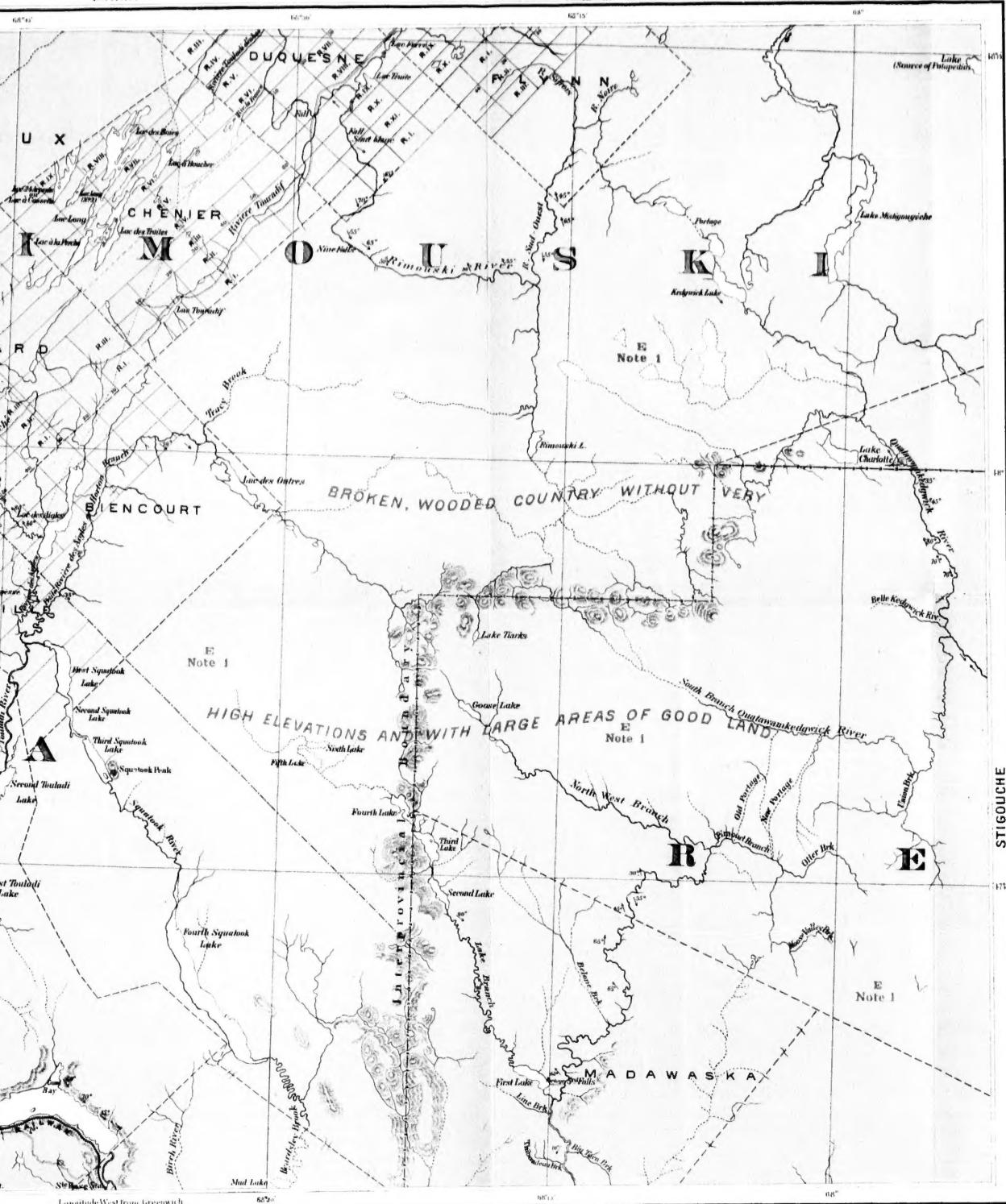
The Canadian Surveyor's Table Sheet.

PROVINCE OF QUEBEC AND PART OF NEW BRUNSWICK

Nat. Scale 1:63,500

Scale Miles to one inch

Scale Miles to one mile



NOTE 1

Large continuous limestone outcrops are situated in the main basin of the St. Lawrence, extending from the mouth of the river up to the Lake St. Pierre, and which are of fairly uniform thickness. The limestone is often interbedded with sand and this fact has led to the development in these of a fine and strong limestone, while with the planes of bedding the limestone has made the building of roads in the interior hopeless. Fossils do not occur in any of the points mentioned about Lake St. Pierre, but a few small outcrops of limestone occur on the lake bank and on the small winding river, as well as in various points on the lake. During the present year the limestone has been found to be of great interest because of its value without any liability that this whole series of beds is a part of the limestone of the St. Lawrence, and it is now known that the limestone of the St. Lawrence is a part of the limestone of the St. Lawrence.

NOTE 2

Extending from the edge of the over-tapping sediment North Westward to the shore of the St. Lawrence is a series of rocks which, from the evidence of the contained fossils, may be here assigned to Cambrian age. The characteristic rocks of the series are red, green, black, and gray shales with bands of thin, light-colored, hard quartzose sandstone, and near the coast, with thin, alternating bands of sandstone and of coarse and fine lime-stone. Calcarenous shales are everywhere much folded and contorted, overthrust, and small local folds occurring at many points. The shales are everywhere charged with iron, and often, together with the greenish-yellow condition, give them a greenish-yellowish tint which is quite difficult. A number of pale greenish-yellow shales, which within the present sheet and beyond its limits, fossils have been found, notably *Calymene planorbis* (Murchison), which defines the Cambrian age of the series. At many places throughout the wilderness land of this area good farming land occurs particularly along the river valleys. The region generally is more rugged and broken however than that occupied by Silurian sediments.

NOTE 3

3.S.W. This small area which is defined by a boundary line on the present sheet but which has not been distinctively colored, consists of red and white quartzose sandstone in many beds. In structure it is a synclinal basin, everything indicating that the shales and sandstones are in outliers which are everywhere derived from it. No fossils have been observed in the sandstones, and we can only say tentatively that they are more recent than the older Cambrian. A few are, however, on the south shore of Lake St. Pierre, and from time to time the lake shore has been taken out. A great number of these shales may be seen in the parts of the culture bridge over the Trois-Rivières River.

To accompany Report by Messrs. Bain and McInnes,
Part M. Annual Report 1889-1890.

THE EASTERN PART OF QUEBEC AND PART OF NEW BRUNSWICK.

Nat. Scale 1:611,440

Scale: Landes to one inch

10 Miles 15 Miles